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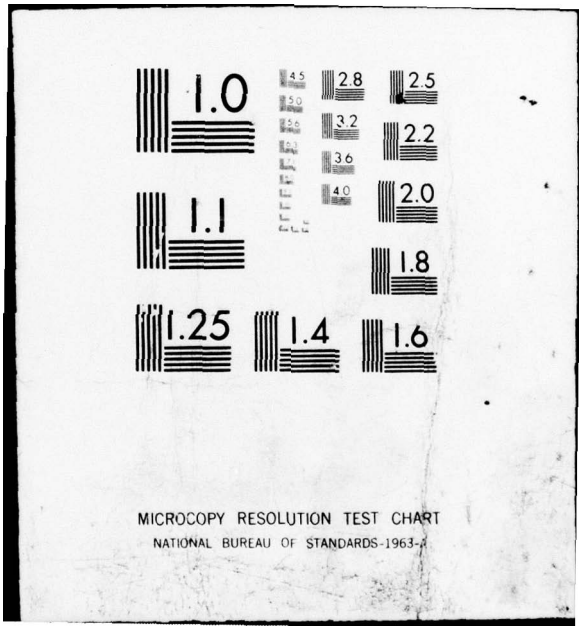
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FINAL REPORT

After a period spanning over twenty years, ONR support on its Cornell Contract (Present #N00014-75-C-0248) is being terminated. During that time a great deal has happened in science and in the National Support of Science. Not only has the Office of Naval Research undergone great changes in that time, but so also has the emphasis in this particular area, which ONR has helped to support over this long period of time. It was originally funded as research into the optical properties of alkali halides. Alkali halides at that time was a big area for Cornell solid state physics research. And for a long time that remained the emphasis in the work on the ONR Contract. This gradually changed and during recent years the work has been directed more toward the use of lasers and development in laser technology. Notwithstanding the shift, ONR was still supportive and the original title was maintained.

While the writer was originally the "principal investigator" and appears thus in the "paperwork", it was not long before Professor Mahr became THE principal investigator, and, in fact, it is largely his work and that of his students that forms the bulk of that done on the Contract and it is to him that so much of the success achieved is due. During the period, through the aid of ONR support, over 15 graduate students have been supported wholly or in part; 5 Post Doctoral appointments have been facilitated, and over 50 journal papers have been published. Many papers, invited and contributed, have been given at meetings. In retrospect, the sum total seems extraordinary, considering the modest level of the yearly support. In concluding the association, the Cornell principal investigators wish to express their appreciation for the ONR support over these many years and for the freedom with which they were allowed to pursue what appeared to be of interest and value, for ONR encourage-

ment, and the friendly, cooperative administration of the long contract.

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The early work was devoted to developing instrumentation for work in the vacuum ultra-violet region of the spectrum. The first physics to come out of it was a study of the reflectivity of NaCl and KCl, in which the exciton absorption peak manifests itself. This was followed by work on the photoelectric properties of some alkali halides, both as bulk single crystals and as thin films. Attempt to see photoconductivity was not successful; it had been anticipated that it would be easily observed; later detection by Teegarden at Rochester showed it to be very small indeed. During this period; various advances in the instrumentation were made, both in sources and in dispersing instruments--the monochromators.

After Professsor Mahr joined the effort, first in a Post Doctoral position, the productivity of the effort increased markedly. His first interests were in the use of the instrumentation in studying mixed alkali halides, exciton structures and luminescence in localized excitons and F-centers. A number of papers came out from this work of Mahr's, probably most importantly that of his study of mixtures and dilute solid solutions of alkali halides leading to the first understanding of Urbach's rule in mixed alkali halides.

Studies in the alkali halides of the localized excitations known as excitons, lead not unnaturally to similar studies in such materials as ZnO, CdS, CdSe, etc.; a fair amount of work on high exciton densities was done. Some of this work was greatly facilitated and made possible only with the introduction of the laser. Almost from the time of its inception, this powerful tool has been a mainstay in the work. Emphasis on alkali halides diminished and work exploiting the unique capabilities of the laser increased. Interest in non-linear optical properties of solids, and picosecond phenomena were outcomes

of this development. More recently, this continuing interest in lasers, and with the advent of holography, concepts in ultraviolet lasers and X-ray holography have been pursued, work quite removed from that which the early stages of the Contract support was concerned.

The chronological listing of the many publications resulting from the long period of effort indicates nicely the trend taken over the years. Not included are abstracts of the many talks and papers given at colloquia and scientific meetings.

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Students and Theses (Supported in whole or in part)

J. G. Siegfried --- "Optical Absorption in Sodium Chloride". M.S. Thesis, 1954

J. R. Nelson --- "Far Ultraviolet Monochromator". M.S. Thesis 1954

T. Timusk --- "Luminescence Study of Alkali Halides in the Vacuum Ultraviolet". Ph.D. Thesis 1961

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J. N. Lloyd -- "Optical Processes in LiF in the Vacuum Ultraviolet". Ph.D. Thesis 1963

E. M. Logothetis --- "Electron Emission from Solids Under the Influence of Laser Radiation". Ph.D. Thesis 1967

F. N. Cirillo --- "Brillouin Scattering in Pure and Mixed Cubic Crystals". Ph.D. Thesis 1969

S. W. Duckett --- "Photoelectric Processes and a Search for Exciton Mobility in Pure and Doped Alkali Halides". Ph.D. Thesis 1969

D. Magde --- "Luminescence Study of Exciton-exciton Interaction in Cds, CdSe, and ZnO". Ph.D. Thesis 1970

J. F. Figueira --- "A Study of Exciton Luminescence in CdS and CdSe at High Exciton Concentrations Using Picosecond and Nanosecond Spectroscopy". Ph.D. Thesis 1971

S. C. Abbi --- "Experimental Studies into the Cause of the Sub-division of an Intense Laser Beam into Small Scale Filaments in Non-Linear Media". Ph.D. Thesis 1971

D. C. Haueisen --- "Resonant Second Harmonic Generation in the Exciton Region of Cuprous Chloride and Zinc Oxide". Ph.D. Thesis 1972.

W. F. Love --- "Low Temperature Brillouin Light Scattering from Phonons Bottlenecked in KCL:OH and from Thermal Phonons in Glass". Ph.D. Thesis 1974

T. Daly --- Ph.D. Thesis in progress.

N. Frigo --- Ph.D. Thesis in progress.

C. Cassidy --- Ph.D. Thesis in progress.

Post Doctoral appointments with at least partial support under the ONR contract:

Dr. George Ruff 1966-68

Dr. Dietmar Fröhlich 1965-67

Dr. T. S. Chang 1971

Dr. U. Roeder 1973

Dr. B. Reuter 1975-6

Visiting Professor:

Prof. W. Martienssen 1960-1